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Indian Standard
SPECIFICATION FOR
NYLON FABRICS FOR
COATING WITH NATURAL OR
SYNTHETIC ELASTOMERS

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Indian Standard

SPECIFICATION FOR NYLON FABRICS FOR COATING WITH NATURAL OR SYNTHETIC ELASTOMERS

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Indian Standard
**SPECIFICATION FOR
NYLON FABRICS FOR
COATING WITH NATURAL OR
SYNTHETIC ELASTOMERS**

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 15 July 1985, after the draft finalized by the Textile Materials for Aerospace Purposes Sectional Committee had been approved by the Textile Division Council.

0.2 For preparing this Standard considerable assistance has been derived from 'BS F127-1983 Specification for nylon fabrics for coating with natural or synthetic elastomers' issued by the British Standards Institution.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS:2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the requirements for a series of nylon fabrics suitable for coating with natural or synthetic elastomers for subsequent use primarily in the manufacture of safety and survival equipment for aerospace purposes.

2. CONDITIONING AND TESTING

2.1 Except where otherwise required as part of the procedure of an individual test, all test samples or specimens cut therefrom shall be conditioned and tested in the standard atmosphere of 65 ± 2 percent relative humidity and $27^\circ \pm 2^\circ\text{C}$ temperature for not less than 24 h (*see also* IS:6359-1971†).

*Rules for rounding off numerical values (*revised*).

†Method for conditioning of textiles.

3. MANUFACTURE

3.1 Yarn

3.1.1 *Type* — The fabric shall be manufactured from continuous filament nylon 6.6. The yarns used shall have the properties as given in Table 1.

TABLE 1 YARN PROPERTIES

dtex/filaments	TENACITY cN/tex	EXTENSION AT BREAK PERCENT	NOMINAL TWIST WARP WEFT (TURNS PER m)		DESIG- NATION OF FABRIC
33 f 10	55 Min	14.5 to 21	300	300	1A
			300	Spinning	1B
			Spinning	300	1C
			Spinning	Spinning	1D
50 f 15	55 Min	14.5 to 21	160	Spinning	2A
			300	Spinning	2B
			Spinning	Spinning	2C
67 f 20	42 nom	30 to 40	320	320	4 A
			320	Spinning	4 B
			Spinning	320	4 C
			Spinning	Spinning	4 D
78 f 20 or 78 f 34	42 nom	30 to 40	Spinning	Spinning	3
110 f 34	68 Min	14.5 to 21	Spinning	Spinning	5
228 f 34	41 nom	30 to 40	Spinning	Spinning	7
235 f 34 or 235 f 36	69 Min	15 to 23	Spinning	Spinning	6,8
470 f 68 or 470 f 72	69 Min	15 to 23	Spinning	Spinning	9,11
950 f 136 or 950 f 140	70 Min	15 to 23	Spinning	Spinning	10

NOTE — Manufacturers may use yarns with or without intermingled filaments provided the requirements of 3.1 are met.

3.2 Fabric

3.2.1 Where the fabric is required to be supplied for coating, any sizes and dressings used in preparation or weaving processes shall be compatible with the coating processes.

NOTE — Certain types of size, for example, those based on polyacrylic acid are known to be incompatible with some elastomers.

3.2.2 The fabric shall be uniformly woven in plain weave and of so much good quality that knots of yarn, unevenness of denier, unevenness of twist and other spinning and weaving defects likely to affect the appearance and serviceability of the fabric are not noticeable. The edges of the fabric shall be straight, even and well made and shall not be substantially thicker than the body of the fabric.

4. FINISH

4.1 General — The fabric shall be supplied in one of the following conditions:

- a) loomstate;
- b) scoured and heat set; and
- c) scoured, dyed and heat set.

NOTE — It is very important that the scouring process is thorough in order to remove surface active agent and processing aids.

4.2 Dyeing — If dyeing is required, the colour shall be as stated in the contract or order. The colour shall be specified by pattern.

5. CONSTRUCTION AND PROPERTIES OF FABRIC

5.1 The fabric supplied shall be as detailed in Table 2.

6. REQUIREMENTS

6.1 Colour Fastness

6.1.1 Dyes known to accelerate actinic damage shall not be used.

NOTE — The following are the colour index numbers of dyestuffs that, either alone or mixed together, are known to have protective effect on nylon 6-6.

acid black	132
acid green	43
disperse yellow	3
disperse orange	3
mordant yellow	34

TABLE 2 CONSTRUCTION AND PROPERTIES OF FABRIC

(Clause 5.1)

DESIGNATION OF FABRIC	NOMINAL YARN COUNT OF WARP AND WEFT (dtex)	MINIMUM No. OF THREADS/cm		MAXIMUM MASS/AREA (g/m ²)	BREAKING STRENGTH ON 5.0×20 cm Strips, Min	
		Warp	Weft		Warp	Weft
					N	N
1A, 1B, 1C, 1D	33	45.5	40.0	35	335	280
2A, 2B, 2C	50	39.5	39.5	50	550	550
3	78	37.0	37.0	65	480	480
						500
4A, 4B, 4C, 4D	67	41.5	39.5	70	530	500
5	110	27.0	27.0	70	830	830
6	235	16.5	16.5	90	1 155	1 155
7	228	26.0	22.0	125	1 135	965
8	235	24.5	24.5	130	1 750	1 750
9	470	13.0	13.0	150	1 850	1 850
10	950	8.0	8.0	185	2 445	2 445
11	470	24.5	16.5	235	2 890	2 225
Method of Test	IS:1315-1977*	IS:1963-1981†		IS:1964- 1970‡	IS:1969-1985§	

NOTE — The fabric may be woven in multiple widths and slit to yield fabric of the width stipulated in the contract or order.

*Method for determination of linear density of yarns spun on cotton system (first revision).

†Methods for determination of threads per unit length in woven fabrics (second revision).

‡Methods for determination of weight per square metre and weight per linear metre of fabrics (first revision).

§Methods for determination of breaking load and elongation at break of woven textile fabrics (second revision).

6.1.2 The colour fastness requirements shall be not less than the values given below:

<i>Agency</i>	<i>Rating</i>	<i>Method of Test</i>
a) Artificial light (change in colour)	5	IS:2454-1985*
b) Washing Test 2 (change in colour and staining of adjacent fabrics)	4	IS:3361-1979†
c) Water (change in colour and staining of adjacent fabrics)	4	IS:767-1956‡
d) Vulcanizing in hot air and in open steam (change in colour)	5	IS:4635 (Parts 1 and 3)-1968§
e) Dry — heat	4	IS:4636-1969

6.2 Water Extractable Matter

6.2.1 For fabrics supplied in loomstate, water extractable matter shall not exceed 2.0 percent and for fabrics supplied either scoured and heat set, or scoured, dyed and heat set, the water extractable matter shall not exceed 1.0 percent when tested according to IS:3456-1966¶.

6.3 Copper Content

6.3.1 The copper content of the fabric as supplied shall not exceed 30 mg/kg when tested according to procedure given in Appendix A.

6.4 Dimensional Stability

6.4.1 Where fabric is to be supplied in loomstate; the dimensional stability to dry heat shall be such that the dimensional change on heating shall not exceed 3.5 percent in either warp or weft direction when tested according to the procedure given in Appendix B.

6.4.2 Where fabric is to be supplied heat set, the dimensional stability to dry heat shall be such that dimensional change on heating shall not exceed 2.0 percent in the warp direction and 3.5 percent in the weft direction when tested according to the procedure given in Appendix B.

*Method for determination of colour fastness of textile materials to artificial light (xenon lamp).

†Method for determination of colour fastness of textile materials to washing: Test 2.

‡Method for determination of colour fastness of textile materials to water.

§Method for determination of colour fastness of textile materials to vulcanizing.

||Method for determination of colour fastness of textile materials to dry-heat treatments.

¶Method for determination of water soluble matter of textile materials.

6.5 Dimensions and Tolerances

6.5.1 Width — The width of fabric shall be not less than that specified in the contract. Variation in width shall not exceed 15 mm (see IS:1954-1969*).

6.5.2 Length — Minimum length of loomstate pieces shall be 100 m for those weighing 435 g or less per square metre, and 50 m for those weighing more than 435 g per square metre. Not more than 5 percent of the pieces shall be in three parts, not more than 25 percent of the remainder shall be in two parts and no parts shall be less than 15 m long: (see IS: 1954-1969*).

6.6 Freedom From Corrosive Impurities

6.6.1 The fabric shall be free from corrosive impurities to the extent that:

- a) The conductivity of the aqueous extract does not exceed 15 mS/m. (see IS: 4420-1967†), or
- b) If this value is exceeded, for example, owing to the presence of adventitious conducting but not specially corrosive matter, the pH value of aqueous extract is not less than 5 or more than 8; water soluble chloride expressed as sodium chloride, does not exceed 0.10 percent; and water soluble sulphate, expressed as anhydrous sodium sulphate does not exceed 0.25 percent (see IS: 1390-1984‡, IS: 4202-1967§ and IS: 4203-1967||).

6.7 Freedom from Defects

6.7.1 The various defects and their method of marking is given in Appendix C. The acceptance limit of these defects shall be such that the lengths per 100 m nominal length affected by defects shall not exceed the following:

- a) Defects hindering fabrication and defects of lay and finish : 5 m;

NOTE — Such fabric can sometimes be made acceptable by suitable refinishing.

- b) Serious defects : 10 m; and
- c) Gross defects : nil

6.7.2 A consignment shall be acceptable only if the total quantity affected by (markable) defects does not exceed 5 percent.

*Methods for determination of length and width of fabrics (first revision).

†Methods for determination of conductivity of aqueous and organic extracts of textile materials.

‡Methods for determination of pH value of aqueous extracts of textile materials (first revision).

§Method for determination of chloride content in textile materials.

||Method for determination of sulphate content in textile materials.

7. SAMPLING

7.1 Lot — The quantity of same type and quality of nylon fabric delivered to a buyer against one despatch note shall constitute a lot.

7.2 The conformity of the lot shall be determined on the basis of tests carried out on the samples selected from it.

7.3 Unless otherwise agreed to between the buyer and the seller the number of pieces selected at random from a lot shall be as follows:

<i>Lot Size</i> (Number of Pieces)	<i>Sample Size</i> (Number of Pieces)	<i>Sub-sample Size</i> (Number of Pieces)
(1)	(2)	(3)
Up to 50	3	3
51 to 150	5	3
151 to 300	8	5
301 and above	13	5

7.4 The pieces selected according to 7.3 (col 2) shall be tested for number of threads/cm, width, length, linear density, mass per unit area and nominal twist of yarns.

7.5 The number of pieces selected for other tests shall be selected from those already tested in 7.4 according to 7.3 (col 3).

7.6 Samples shall not be taken from first few metres of fabric manufactured or within 1/10th of the fabric width from the selvages.

8. MARKING

8.1 The fabric shall be marked with the following:

- Name and designation of the material;
- Textile specification;
- Manufacturer's name, initials or trade-mark;
- Number of defects marked in accordance with Appendix C;
- Number of portions, if more than one;
- Date (month and year) of manufacture;
- Length and width of fabric;
- Any other marking as specified in the contract or order.

8.2 The markings shall be legible and permanent.

8.3 The markings shall be on a durable label which shall be securely attached to each separate piece.

9. PACKING

9.1 The fabric shall be packed in rolls or cases in conformity with the procedures laid down either in IS:2194-1963* or in IS:2195-1964†.

10. CRITERIA FOR CONFORMITY

10.1 The lot shall be declared conforming to the requirements of this standard if the following conditions are satisfied:

- a) All the pieces selected according to 7.3 satisfy the relevant requirements for each of the characteristics as mentioned in this standard.
- b) From the test results for mass the average \bar{X} and R shall be calculated and the value of the expression $\bar{X} + 0.6 R$ is less than or equal to the upper limit.
- c) From the test results for breaking strength the average \bar{X} and the range R shall be calculated and the value of the expression $\bar{X} - 0.6 R$ is greater than or equal to the value given in this specification.
- d) All the test specimens tested for the characteristics as mentioned in 6.1 to 6.7 satisfy the corresponding requirements.

A P P E N D I X A

(Clause 6.3.1)

DETERMINATION OF COPPER CONTENT

A-1. APPARATUS

A-1.1 Kjeldahl Flasks

A-1.2 Standard Flasks — 50 ml capacity.

A-1.3 Colorimeter

A-1.4 Separating Funnels

A-2. REAGENTS

A-2.0 Quality of Reagents — Unless specified otherwise, pure chemicals shall be employed in tests and distilled water (see IS:1070-1977‡) shall be used where the use of water or distilled water as a reagent is intended.

NOTE — 'Pure Chemicals' shall mean chemicals that do not contain impurities which affect the experimental results.

*Code for seaworthy packaging of man-made fibre fabrics.

†Code for inland packaging of man-made fibre fabrics and man-made fibre yarns.

‡Specification for water for general laboratory use (second revision).

A-2.1 Nitric Acid — concentrated.

A-2.2 Sulphuric Acid — concentrated.

A-2.3 Ammonia Solution — specific gravity 0·880.

A-2.4 Citric Acid

A-2.5 Sodium Diethyl Dicarbamate [0·1 percent (m/V)] Solution — freshly prepared.

A-2.6 Amyl Alcohol — neutral, re-distilled.

A-2.7 Cupric Sulphate Penthydrate

A-3. PREPARATION OF DIGESTION LIQUID

A-3.1 Place 1 g of the test sample, cut into small pieces, in a Kjeldahl flask and, add nitric acid and sulphuric acids, noting the volumes. Heat the contents of the flask, adding nitric acid as necessary, until the mixture is colourless, noting the volume added.

A-3.2 Carry out a blank digestion simultaneously with the sample digestion, using the same volumes of reagents as for the sample digestion.

A-3.3 Evaporate to small bulk, cool, dilute with 10 ml of distilled water, re-boil, cool and transfer to standard flask.

A-3.4 Wash out the digestion flask with about 30 ml of distilled water in three separate portions.

A-3.5 Add the washings to the bulk and make up to 50 ml with distilled water.

A-4. DETERMINATION OF COPPER CONTENT

A-4.1 Prepare a copper solution containing 0·01 mg of copper per millilitre, by dissolving 0·0393 g of cupric sulphate penthydrate and 1 ml of sulphuric acid in distilled water and diluting it to 1 litre with distilled water.

A-4.2 Place 25 ml of solution from the same digestion (*see* A-3.5) in a separating funnel. Add 10 ml cold ammonium citrate solution (prepared by mixing equal volumes of ammonia solution and a solution of 50 g of citric acid in 100 ml of distilled water), 5 ml of ammonia solution and 10 ml of sodium diethyldithiocarbamate solution.

A-4.3 Add 50 ml of amyl alcohol and shake the contents of separating funnel.

A-4.4 Draw off and discard the aqueous layer. Filter the amyl alcohol layer, if necessary (extract A).

A-4.5 Using the quantities of reagents and the procedure given in **A-4.2** to **A-4.4** prepare an extract from the 25 ml of solution from the blank digestion (extract B) and an extract from a suitable volume (between 1 and 10 ml) of the standard copper solution (extract C).

A-4.6 Prepare an extracts from the reagents used (that is 10 ml of cold ammonium citrate solution, 5 ml of ammonia and 10 ml of sodium diethyl-dithiocarbamate solution) by shaking the reagents with 50 ml of amyl alcohol in a separate funnel (extract D).

A-4.7 Separately compare extracts A, B and D with extract C in the colorimeter.

NOTE — For the purpose of comparison of extracts A and B with extract C, the amount of copper in extract C is to be regarded as increased by the amount found in extract D.

A-4.8 Deduct, from the amount of copper in extract A, the amount found in extract B, for calculation of the percentage of copper in the textile.

A-5. REPORT

A-5.1 Calculate and report the percentage of copper.

A P P E N D I X B

(*Clause 6.4.1*)

DETERMINATION OF DIMENSIONAL STABILITY TO DRY HEAT

B-1. PREPARATION OF SPECIMEN

B-1.1 Cut from the test sample a specimen not less than 300 mm square and make three pairs of marks in the warp and weft directions as shown in Fig. 1.

B-2. PROCEDURE

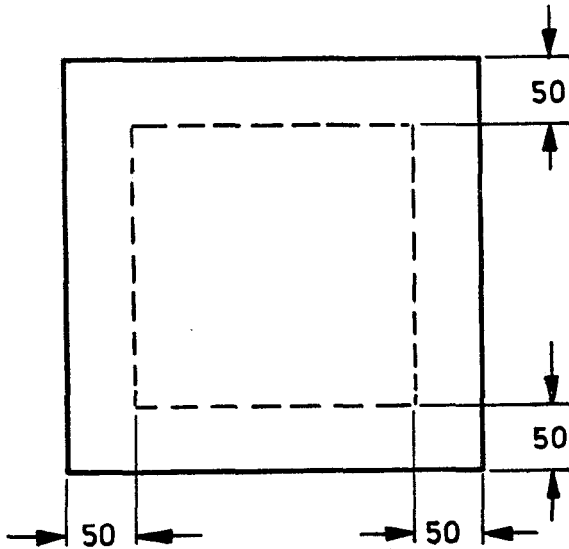
B-2.1 With the specimen laid on a flat surface and covered with a sheet of plate glass, accurately measure the distance between each pair of marks.

B-2.2 Place the specimen in an air oven at a temperature of $150 \pm 2^{\circ}\text{C}$.

B-2.3 After 15 min, remove the specimen and condition it as specified in 2.

B-2.4 Repeat the measurements through the plate glass.

B-2.5 Report — Report as percentages, the mean changes in length in the warp and weft directions.



All dimensions in millimetres.

FIG. 1 PREPARATION OF SPECIMEN

APPENDIX C

(Clause 6.7.1)

DEFECTS IN FABRIC AND THEIR METHOD OF MARKING

C-1. WOVEN FABRICS

C-1.1 Minor Defects — Defects visible and liable to lead to queries but, unless very frequent, not justifying special attention or penalty.

C-1.2 Defects Hindering Fabrication — Defects implying some inconvenience in subsequent fabrication and so justifying temporary marking.

- a) Width deviation : outside the limit specified in this standard,
- b) Incorrect selvedge lay : any part slack, wavy or tight,
- c) Incorrect or missing identity colours : any part exceeding 250 mm without colours where specified.

C-1.3 Defects of Lay and Finish Hindering Subsequent Coating — Defects resulting in any portion of the fabric showing departure from flat lay.

- a) Creases,
- b) Furrows,
- c) Longitudinal bars of relatively tight or slack warp threads, and
- d) Tight or slack selvedges.

C-1.4 Serious Defects — Defects affecting performance and requiring cutting out by the contractor.

a) *Broken Threads*

- 1) In fabrics with a total of 40 or less threads (warp plus weft) per centimetre : a single broken thread.
- 2) In fabrics with a total of 40 but not more than 80 threads (warp plus weft) per centimetre : two or more adjacent or alternate broken threads or a single thread broken for more than 75 mm.
- 3) In fabrics with a total of more than 80 threads (warp plus weft) per centimetre : two or more adjacent or alternate broken threads, except in fabrics for coating when up to four ends broken or three ends broken for not more than 75 mm are classed as minor defects provided that the fabric has been carefully combed and dressed at the thin place.
- b) *Mechanical Injuries* — Holes, cuts etc, judged in extent as in (a) above.
- c) Loose threads, loops or groups of minor floats if not neatly trimmed off or if, after trimming, broken threads occur as in (a) above.
- d) Float over 6.5 mm square or, if over 13 mm long or broad, noating over more than four threads.
- e) Hard inclusions.
- f) In fabrics for coating only, soft inclusions such as slubs, fur and sloughed weft, liable to protrude through coating films which are often about 0.1 mm thick.

NOTE — Soft inclusion are not regarded as harmful in fabrics not intended for coating.

- g) Badly made pull backs.
- h) Bad starting places so thin that a 25 mm length of fabrics, including the starting place, has pick count more than 10 percent below normal or if having a ribbed or poplin appearance extending from selvedge to selvedge.

NOTE—To avoid serious weakness at starting places, weavers should be required to relieve warp tensions or close the shed, or do both, when looms are stopped overnight.

- i) Stains, unless the causes are known and the effects are known to be harmless.

C-1.5 Gross Defects (Fabrics for Coating Only)— Defects preventing coating and requiring removal by cutting out the defective areas across the full fabric width and making a butt seam (overlap seams are not acceptable).

- a) Bad smashes,
- b) Holes larger than 6 mm square,
- c) Very large floats,
- d) Missing weft across full width for more than 6 mm, and
- e) Mechanical damage of similar magnitude.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition</i>
Force	newton	N	1 N = 1 kg. m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s(s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²